OLD GROWTH
CHARACTERIZATION AND MANAGEMENT
IN THE NELSON FOREST REGION

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ABSTRACT

The Biodiversity Guidebook contains two different definitions of old growth - one based on age, and one based on structural characteristics. The latter definition was not described in detail by the Provincial Biodiversity Committee due to the absence of data.

This report presents a quantitative assessment of the structural characteristics of old growth stands in the Nelson Forest Region, and it outlines the key characteristics for old growth by variant and site series. Together with an earlier technical report (TR-013), the reader has a complete set of regional standards, additional data on tree species and snag composition, and other data for old-growth stands.

This information should form the basis of old-growth management initiatives based on structure, in the NFR.

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1 INTRODUCTION

Old-growth is an important issue in the Kootenay region. Planning activities such as the Protected Areas Strategy (PAS) created the need for regional inventories of old-growth and identification of rare old-growth ecosystems. Planning also requires verification that rare stands identified from forest cover maps do exhibit old-growth characteristics, and verification necessitates standards for comparison. The Biodiversity Guidebook of the Forest Practices Code (British Columbia Ministry of Forests and Ministry of Environment 1995) has old-growth requirements specified for biogeoclimatic units within landscape units. These requirements primarily use age-based definitions. Several tables in the guidebook recommend the development of definitions based on attributes of "natural" stands. Although Appendix 5 of the Guidebook provides general guidance for important stand characteristics, specific old-growth characteristics are not presented. Thus regional standards are needed, based on stand properties that can be readily measured and used by managers and technicians. The goal of this summary and the associated research is to develop stand attribute definitions for old-growth in site series of the Kootenays.

Studies on ecological processes have generally considered old-growth from two main perspectives. The first perspective is the stand dynamics approach of Oliver and Larson (1990). Old-growth is considered the last stage of stand development between disturbances. The second perspective focuses on structures rather than on stand development processes. Oliver and Larson (1990) also discuss this alternative perspective. They note that structures are more important for wildlife and recreational use than any nominal stage of stand development. Wildlife use associated with structural attributes has been the focus of several studies and reviews (e.g. Thomas et al. 1979; Mannan and Meslow 1984, Bunnell and Allave-Chan 1987, Hunter 1990). These studies emphasize that old-growth stands are important for wildlife because of the presence of relatively high concentrations of trees, snags, and woody debris with dimensions that tend to be in the largest size classes found in natural systems. This principle appears to hold for the Nelson Forest Region as demonstrated by a recent study near Kootenay Lake. Steeger and Machmer (1995) found that the majority of wildlife trees used were >40 cm in diameter and at least 15-20 m in height. Thus, for purposes of retaining attributes that are of value for wildlife and recreation in the Nelson Forest Region, old-growth was considered in terms of important structural features rather than as a stage in stand development.

The methods used for developing regional standards, for sampling potentially rare stands, and for comparing the rare stands to regional standards are described in Quesnel (1996). The reader is referred to this document for the complete set of regional standards, additional data on tree species and snag composition, and other data for old-growth stands. Data for three stands and

the corresponding standard for the variant were extracted from Quesnel (1996) to illustrate how stands can be assessed for old-growth value. The purpose of this summary is to show how standards can be used, in resource management, to assess stands for old-growth characteristics or to provide targets for old-growth recruitment. The present report discusses the data for these three sites and some general guidance for old-growth management.

2 METHODS

A geographical information system (GIS) was used to identify potential old-growth stands, including relatively rare ecosystems, in the Nelson Forest Region (Quesnel and Leahy 1993). Maps and databases for forest cover, BEC (biogeoclimatic ecosystem classification) variants, and ecosections were combined. Age classes 8 + 9 (>140 years old) were identified as potential old-growth stands. This age-class based criteria was recommended by the Old-Growth Task Force for identifying old-growth stands (British Columbia Ministry of Forests 1992). Biogeoclimatic variants were considered to have rare old-growth if age classes 8 + 9 occupied <10% or <1 000 hecatres of the unit. The BEC standards for old-growth in the Nelson Forest Region were derived from the historic stand data collected for the BEC sampling program (Braumandl and Curran 1992). The standards are statistics for stand variables summarized by variant and site series (Quesnel 1996). The stand variables include age of the dominant/codominant tree layer and the densities of large trees and snags greater than specified minimum diameters at breast height (dbh). The specified dbh's were 30, 40, and 50 cm. Oldest stand age was noted for each site series. Basal area was also calculated for the specified dbh's, to provide guidance for stand management.

A field reconnaissance was undertaken of potentially rare old-growth stands identified by the GIS exercise. Field reconnaissance included a transect through the stand to collect a few tree ages and diameters. This information was used to determine if stand age or structural attributes appeared to meet the minimal standards for the variant. Where the reconnaissance indicated old-growth characteristics, the stand was sampled for the same variables as the standards. The mean stand values for the potentially rare old-growth stands were compared to the BEC summary data to determine if the rare stands were high-quality, structural, old-growth. For a particular variable, if the stand mean for a rare stand was equal to or greater than the mean minus one standard error for the site series and variant in the BEC summary data, the stand was considered to meet the old-growth standard for that variable. Mensuration data were not collected for a few site series in the BEC sampling program in the Nelson Forest Region. For potential old-growth stands in these site series, the closest site series, in terms of moisture status, was used for comparison.

3 RESULTS AND DISCUSSION

Summary statistics for site series within the ESSFdk, ICHmw2, and IDFdm2 are included in Table 1. It must be emphasized that this table includes only part of the regional standards presented in Quesnel (1996), and the operational user is referred to this latter report for a complete list of variant standards. Data are missing for some ecological units, because stands >140 years were not sampled for some units in the BEC sampling program. For example, in Table 1, there are no data for the 04 site series of the IDFdm2. Also, for site series where only one stand was sampled, there is no standard error. The reader is cautioned to review the data for similar site series to ensure that the standard does not appear to have anomalously high or low values. If the values for a site series appear to be unusually high or low, relative to other units in a variant, a standard for a similar site series should be substituted. Table 1 also includes information on maximum tree age, basal areas, and snag frequency. These variables are used for developing stand prescriptions in old-growth management.

Three stands identified by GIS as potentially rare old-growth were sampled (Table 2) and compared to the regional standards based on stand age and tree densities (Table 1). The results of the comparisons were used to generate Table 3. The comparison of stand data for Quinn Creek North (Table 3) used a standard for comparison that had only one stand sampled (ESSFdk - 02 site series, Table 1). Standard errors could not be calculated for any of the variables. Thus, the means were used for comparison. This comparison is more conservative than for other standards where standard errors could be calculated. It would also be more difficult to find stands that meet these values. However, the stand data for Quinn Creek North were greater than the mean of the standard for all variables except the density of stems >30 cm. Even for this variable, the stand value was almost equal to the standard (Tables 1 and 2). Thus, the stand at Quinn Creek North was rated as old-growth. A second stand sampled for potential old-growth at Granby 32 (Tables 2 and 3) met the mean minus one standard error for all the variables of the standard (Table 1). Stand age and the densities for trees >40 and >50 cm were all greater than the mean for the comparable standard. In this case, the standards for the ICHmw2 - 01 site series were derived from data from 14 stands (Table 1). Thus, Granby 32 readily met the standards and was considered old-growth. The final stand sampled for potential old-growth, at Perry Creek North, was not considered to be old-growth. The standard for comparison, the IDFdm2 - 03 site series, had only one stand sampled. Although the mean stand age at Perry Creek North was close to the stand age for the standard, the densities for the large trees at this site were less than half the values for the standard (Tables 1 and 2). The stand at Perry Creek North was thus rejected as an old-growth stand. This stand could be managed to attain old-growth attributes. The stand could

be designated as an old-growth management area and simply be allowed to grow older. This should allow the density of larger, living or dead trees to increase. Another management option would be to remove smaller stems, do a low-intensity understorey burn to remove regeneration, and allow for more rapid growth of the residual large stems. This would mimic stand development in natural disturbance type 4 (British Columbia Ministry of Forests and Ministry of Environment 1995). This disturbance type has stand-maintaining fires that reduce stand densities and result in larger average stand diameters, compared to unburned sites. These low-intensity fires also yield stands with a higher proportion of ponderosa pine and western larch.

Some potential old-growth stands will exist for which site series data were not collected for stands >140 years old in the BEC sampling program. Development of prescriptions for managing old-growth using the standards of Quesnel (1996) could use an alternative strategy for these sites. The strategy would be to use the standards for another site series that is closest in terms of moisture status and tree species composition. The other site series could be in the same variant, the same subzone, or a similar zone. For example, a stand sampled at Sanca Creek, on the eastern shore of Kootenay Lake, was in the ICHxw - 02 site series (Quesnel 1996). Data were not collected for older stands in this variant in the BEC sampling program. Thus, the stand variables for Sanca Creek were compared to the standard for the 01a site series of the ICHdw. Since the Sanca Creek stand had a density for stems >50 cm that met this standard, the stand was rated as old-growth.

In summary, verification of old-growth or development of stand targets should be based on: 1. the mean less one standard error for variables in Tables 1-4 of Quesnel (1996), 2. the mean value from the same tables if only one stand was sampled for the site series, or 3. values for a similar site series. These are listed in decreasing priority.

4. MANAGEMENT APPLICATIONS

Forestry personnel often have to manage for old-growth. The following illustrates how a forest manager or technician might utilize Quesnel (1996) and the data summaries to inventory and manage for old-growth. The method is described in more detail in Section 5.3 of Quesnel (1996).

The first step is to specify, at the appropriate planning level, the proportion of a potential old-growth area that should meet the minimal structural attributes. This allows for younger patches that occur naturally in old-growth stands. The second step is to obtain detailed inventory data for the stand at a scale of 1:20 000 or larger. In some cases, ages plus counts of trees and snags greater than minimum dbh's may provide a quick and adequate assessment of the stand. Data for local cavity nesters, ungulates, or other species could also be gathered and correlated with the tree inventory. Stand data on other attributes such as coarse woody debris may also be useful for

developing stand prescriptions. The third step is to compare the stand data with the standards developed from the BEC sample data (Quesnel 1996, Tables 1–4). This procedure is described in the previous sections of this summary. The final step is to use the stand data plus old-growth ratings to manage the stand or to reject the stand if it does not meet any minimal standard. The stand may have to be retained and managed as an old-growth recruitment area if area requirements are not met and older stands are not available.

The old-growth standards provide **minimal** management targets in terms of stand attributes. The user should aim to meet at least the minimum standards for old-growth attributes and preferably exceed these values. For example, maximum stand or tree age can be considerably greater than mean stand age (Tables 1 and 2). Old-growth stands also have a significant snag component (Tables 1 and 2). This indicates that the management plan should allow for some trees older than the mean stand age, including large snags. Also, larger-diameter trees have greater and longer-lasting wildlife value. These trees also provide much of the esthetic appeal of old-growth stands for humans. Larger trees form a more significant component of stands in wetter, lower-elevation BEC variants. For example, trees >75 cm dbh have a density of 20 stems/hectare or greater in most site series of the ICHmw2. Therefore, trees much greater than 50 cm dbh are desirable and recommended. Basal areas for larger stand components (Table 1) can be used for developing stand prescriptions. Old-growth management does not preclude all timber harvesting. Thinning of small-diameter trees may be desirable to accelerate the growth of the remaining trees and thus shorten the time required to achieve the desired sizes. Thinning combined with controlled underburns would mimic natural processes in the IDF and PP zones.

5 LITERATURE CITED

British Columbia Ministry of Forests. 1992. An Old-growth Strategy for British Columbia. Report by Old-Growth Task Force, May 1992. Queen's Printer, Victoria, B.C.

British Columbia Ministry of Forests and Ministry of Environment. 1995. Forest Practices Code of British Columbia- Biodiversity Guidebook. Victoria, B.C.

Braumandl, T.F. and M.P. Curran (compilers and editors). 1992. A field guide for site identification and interpretation for the Nelson Forest Region. B.C. Min. For. Res. Br. Victoria, B.C. Land Manage. Handb. No. 20. Victoria.

Bunnell, F.L. and A. Allaye-Chan. 1987. Potential of winter range reserves for ungulates as a habitat for cavity-nesting birds. *In* Fish and wildlife relationships in old-growth forests. W.R. Meehan, T.R. Merrell, and T.A. Hanley (editors). Proc. symp. held April 12-15, 1987 at Juneau, Alaska. pp. 357-365.

Hunter, M L., Jr 1990 Wildlife, forests, and forestry-principles of managing forests for biological diversity Prentice Hall, Englewood Cliffs, N J

Mannan, R W and E C Meslow 1984 Bird populations and vegetation characteristics in managed and old-growth forests, northeastern Oregon J Wildl Manage 48 1219-1238

Oliver, C D and B C Larson 1990 Forest stand dynamics McGraw-Hill, Inc New York, N Y

Quesnel, H J 1996 Assessment and characterization of old-growth stands in the Nelson Forest Region B C Min For., Forest Sciences and Planning Sections, Nelson, B C Tech Rept TR-013

Quesnel, H J and J K Leahy 1993 Forests greater than 140 years old in the Kootenay-Boundary Region-status report B C Min For., Forest Sciences and Planning Sections, Nelson B C Tech Rept TR-004

Steeger, C and M M Machmer 1995 Wildlife trees and their use by cavity nesters in selected stands in the Nelson Forest Region B C Min For., Forest Sciences Section, Nelson, B C Tech Rept TR-010

Thomas, J W., R G Anderson, C Maser, and E L Bull 1979 Snags *In* Wildlife habitats in managed forests-the Blue Mountains of Oregon and Washington J W Thomas (technical editor) USDA For Serv., Portland, Oreg Agric Handb No 553 pp 60-77

TABLE 1. BEC stands greater than 140 years old: statistics for stand age, tree densities, basal area, and snags by site series within variants

Variant/ site series	Sample size[2] (n)	Stand age (yr)	Maximum stand age (yr)	Tree density (stems/ha) >30cm dbh	>40 cm dbh	>50 cm dbh	Basal area[1] (m²/ha) >30 cm dbh	>40 cm dbh	>50 cm dbh	Snags[3] (%)
ESSFdk										
01	2	181.2(16.46)[4]	198	263.1(20.22)	119.7(45.44)	63.3(17.84)	45.0(4.00)	37.5(9.50)	23.5(4.50)	14.6
02	1	179.0(-[5])	179	264.2(-)	60.4(-)	37.5(-)	32.0(-)	12.0(-)	8.0(-)	20.1
03	10	187.4(15.23)	272	188.9(40.62)	54.0(25.85)	17.3(9.38)	21.8(5.19)	9.7(4.41)	4.1(2.83)	24.3
04	11	217.3(11.56)	280	169.1(29.07)	52.5(14.13)	29.0(13.87)	23.6(5.64)	12.8(4.24)	8.5(4.40)	13.0
05	3	169.9(12.54)	187	237.5(46.16)	67.7(34.19)	18.0(11.48)	26.3(6.94)	11.0(5.51)	3.7(2.33)	8.0
06	2	175.6(3.62)	179	250.1(33.78)	83.9(7.26)	29.0(28.98)	32.5(2.50)	16.5(1.50)	7.5(7.50)	0.8
ICHmw2										
01	14	197.8(14.90)	315	280.6(32.02)	166.3(14.88)	77.0(11.92)	39.4(3.33)	38.6(3.47)	24.6(4.10)	7.3
03	1	223.0(-)	223	174.4(-)	116.1(-)	104.8(-)	48.0(-)	42.0(-)	40.0(-)	11.3
04	6	184.0(11.73)	239	257.0(17.38)	170.6(30.75)	103.3(22.21)	49.0(5.79)	40.7(7.89)	29.0(6.57)	9.7
05	17	184.6(8.72)	227	239.2(28.45)	174.0(14.14)	121.4(11.55)	71.2(8.20)	64.8(8.61)	56.5(9.16)	5.3
06	9	181.8(11.97)	245	248.4(56.93)	176.6(29.54)	123.4(18.01)	77.8(12.42)	71.1(11.36)	62.9(10.39)	12.7
HDFdm2										
01	2	145.3(0.25)	146	176.0(71.07)	71.5(36.81)	22.1(22.05)	22.0(10.00)	12.5(7.50)	5.0(5.00)	4.4
03	1	141.0(-)	141	268.8(-)	133.7(-)	27.2(-)	35.0(0.00)	22.0(0.00)	6.0(0.00)	33.4

[1] Basal areas and snag frequencies are not part of the old-growth standards. These values are provided for use in developing stand prescriptions.

[2] Sample size refers to number of stands sampled.

[3] Snags include tree classes 3 (dead potential) and 4 (dead useless). Values are percent of total stems (>7.5cm).

[4] Mean with standard error in brackets.

[5] "-" indicates missing data or value could not be calculated.

TABLE 2. Sites sampled for old growth: statistics for stand age, tree densities, basal area, and snags

Variant/ site series	Location	Sample size[2] (n)	Stand age (yr)	Maximum tree age (yr)	Tree density (stems/ha)			Basal area[1] (m^2/ha)			Snags[3] (%)
					>10 cm dbh	>40 cm dbh	>50 cm dbh	>30 cm dbh	>40 cm dbh	>50 cm dbh	
ESSFdk 02	Quinn Creek North	4	210 2(49 19)[4]	348	237 5(47 32)	150 0(35 36)	87 5(23 94)	57 8(12 14)	49 9(11 86)	39 6(9 80)	18 4
ICHmw2 01	Granby 32	2	254 2(0 17)	481	275 0(25.00)	175 0(25 00)	150 0(0 00)	82 6(10 18)	73 9(15 09)	69 6(10 82)	6 8
IDFdm2 03	Perry Creek North	4	134 7(22 48)	267	93 7(42 54)	56 2(31 25)	12 5(7 22)	15 1(6 19)	11 5(4 41)	4 72(3 27)	3 8

[1] Basal areas and snag frequencies are not part of the old-growth standards. These values are provided for use in developing stand prescriptions.
[2] Sample size refers to number of plots sampled within a stand.
[3] Snags include tree classes 3 (dead potential) and 4 (dead useless). Values are percent of total stems (>7.5cm).
[4] Mean with sampling error in brackets for all mensuration variables.

TABLE 3. Rare old-growth stands compared to standards for Nelson Forest Region

Variant	Site series	Location	Stand age (yr)	Tree density (stems/ha) >30 cm dbh	>40 cm dbh	>50 cm dbh	Comments
ESSFdk	02	Quinn Creek North	Y[1]	N	Y	Y	Old growth[2]
ICHmw2	01	Granby 32	Y	Y	Y	Y	Old growth
IDFdm2	03	Perry Creek North	N[3]	N	N	N	Does not meet old-growth standards for this site series

[1] Y=stand value is equal to or greater than mean - 1 standard error for same variant and site series in Table 1. N=stand value does not meet value calculated for same variant and site series.

[2] Stand meets Nelson Forest Region old-growth standards. Standards are derived from analysis of BEC sample plots >140 years old.

[3] Note that some older trees >200 years old were sampled in stand during reconnaissance. These trees were outside sample plots. Plots also had a range of age classes that can characterize some types of old growth.